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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/045,924	01/14/2002	Alfred W. Greenwood	2802-257-058	1835

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EXAMINER

EGAN, BRIAN P

ART UNIT

PAPER NUMBER

1772

DATE MAILED: 08/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/045,924

Applicant(s)

GREENWOOD ET AL.

Examiner

Brian P. Egan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-74 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-74 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 and 3. 6) ☐ Other: ____

DETAILED ACTION

Claim Objections

1. Claims 1, 20, 39, and 57 are objected to because of the following informalities: in each of the aforementioned claims, there is a minor typographical error wherein the term “having a having a” is used. The Examiner suggests deleting one of the “having a” to facilitate clarity. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 2-3, 21-22, 40-41, and 58-59 are rejected under 35 U.S.C. 112, second paragraph, for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as his invention. The terms “normal room temperature” and “operating temperature” are unclear. What temperature and/or temperature range is the Applicant intending to include within the bounds of “normal room temperature” and “operating temperature”? Proper clarification and/or correction are required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-6, 9-25, and 28-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergerson (#6,090,484) in view of Shores (#5,061,549).

Bergerson teaches a laminar, thermally-conductive interface interposable intermediate a first heat transfer surface and an opposing second heat transfer surface to provide a thermally-conductive pathway therebetween (see Abstract), said interface having a first interface surface disposable in heat transfer contact with the first heat transfer surface (Fig. 1, #11) and an opposing second interface surface disposable in heat transfer contact with the second heat transfer surface (Fig. 1, #12), the interface comprising a first layer formed of a flexible lamellar graphite material (which is broadly inclusive of intercalated graphite flake) (see Abstract; Col. 2, lines 18-21), the first layer having a first interior surface and a first exterior surface defining the first interface surface of the interface (see Fig. 1), and a second layer formed of a phase-change material (Col. 4, lines 6-10), the second layer having a second interior surface joined to the first interior surface of the first layer and a second interface surface defining the second interface surface of the interface (see Fig. 1). The interphase material is form-stable at normal room temperature in a first phase and conformable to the second interface surface in a second phase (Col. 5, lines 22-30), the phase-change material having a transition temperature above normal room temperature from the first phase to the second phase (Col. 4, lines 6-10). The first heat-transfer surface is located on a heat-generating source having an operating temperature above normal room temperature (Col. 1, lines 54-60) and the transition temperature of the phase-change material is within the operating temperature of the heat-generating source (Col. 4, lines 6-10). The transition temperature of the phase change material is between about 40 and 80 degrees Celsius (Col. 4, lines 6-10). The heat generating source is an electronic component and the

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second heat transfer surface is located on a thermal dissipation member such as a heat sink or circuit board (see Abstract). Given that the phase-change material comprises a hot-melt adhesive, the phase-change material is inherently tacky such that the second exterior surface thereon is adherable by the phase-change material to the second heat transfer surface (Col. 5, lines 22-30). The phase change material comprises an admixture of a polymeric components comprising one of more resins, one or more waxes, or a blend of one or more waxes and one or more resins (Col. 5, lines 22-30). The resins and/or waxes are selected from thermoplastics, pressure sensitive adhesives, paraffinic waxes, and blends thereof (Col. 5, lines 22-30). The interface has a thermal impedance of less than about $1\text{ }^{\circ}\text{C}\cdot\text{in}^2/\text{W}$ and a thermal conductivity $3.0\text{ W/m}\cdot\text{K}$ (Col. 6, lines 7-11). Given that the thermal impedance is $0.09\text{ }^{\circ}\text{C}\cdot\text{in}^2/\text{W}$, both the first and second layers implicitly comprise thermal impedances within the Applicant's claimed ranges in claims 18 and 19. Finally, the thickness of the first layer is 6 mils (Col. 4, lines 41-42).

Although it is implicit that the adhesive layer is conductive, Bergerson fails to teach that the second layer is thermally conductive by means of a thermally conductive filler. Bergerson also fails to teach that the thickness of the second layer is between 2 and 20 mils.

Shores, however, teach a hot-melt adhesive for electronic applications that may optionally comprise up to 45% (see Abstract) of a thermally conductive inorganic filler selected from the group consisting of silver, gold, alumina, beryllia, silica, silicon carbide, barium titanate, steatite, boron nitride, and aluminum nitride (Col. 3, line 68 to Col. 4, line 3). In electronic applications, Shores teaches that the thickness of the adhesive layer should be limited between 2 and 15 mils since a thickness below 2 mils results in voids in the bond between the adhesive and electronic application and a thickness in excess of 15 mils takes up too much space

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in a microcircuit device and insulates it thermally (Col. 2, lines 31-41). Shores teaches the use of the thermally-conductive additive for the purpose of providing the adhesive with an improved thermal conductivity, i.e., between 0.7 and 4 W/m °C, while also preventing deterioration of the adhesive properties of the hot-melt adhesive (Col. 3, lines 49-61 and Col. 4, lines 5-9). It would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have combined the teachings of Bergerson and Shores since both of the aforementioned references are analogous insofar as providing adhesive thermal interface substrates in order to facilitate heat dissipation from an electronic application.

Therefore, it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have modified Bergerson by including up to 40% thermally conductive filler as well as limiting the thickness of the adhesive layer between 2 and 15 mils as taught by Shores in order to provide the adhesive with an improved thermal conductivity, i.e., between 0.7 and 4 W/m °C, prevent deterioration of the adhesive properties of the hot-melt adhesive, and to provide an adhesive free of voids at the connection interface without being too cumbersome.

6. Claims 7-8 and 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergerson ('484) in view of Shores ('549), and further in view of Oeltjen et al. (#6,433,069),

Bergerson and Shores teach a thermally conductive interface as detailed above. The aforementioned prior art is silent as to whether the interface is cleanly releasable from the electronic components. It is notoriously well known in the hot-melt adhesive art, however, that plasticizing oil may be added to the hot-melt adhesive composition in order to form a removable hot-melt adhesive that allow separation of the adhesive from an attached substrate without

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substrate failure or adhesive failure as evidenced by Oeltjen et al. (Col. 1, lines 40-52). It would have been obvious to combine the teachings of Bergerson, Shores, and Oeltjen et al. since each of the aforementioned references are analogous insofar as each of the three references are directed at the formation of hot-melt adhesives.

Therefore, it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have modified the adhesives of Bergerson and/or Shores by including plasticizing oil as taught by Oeltjen et al. in order to impart repositionable properties to a hot-melt adhesive such that the adhesive is removable from an attached substrate without substrate failure or adhesive failure.

7. Claims 39-44, 47-62, and 65-74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergerson ('484) in view of Shores ('549) and Columbier et al. (#5,100,737).

Bergerson and Shores teach a thermally conductive interface as detailed above. The aforementioned prior art fails to teach a first layer comprising a tin foil material.

Columbier et al., however, teach a flexible graphite substrate for electronic applications wherein the graphite substrate is reinforced with electroplated metal layers (including iron) (Col. 2, line 34-42; Col. 4, lines 27-34) thereby creating a graphite substrate reinforced with metal foil. Columbier et al. teach the use of the metal reinforcement for the purpose of improving the mechanical strength of the substrate while also reducing the electrical resistance and enhancing thermal conductivity of the substrate (Col. 2, lines 34-42; Col. 4, lines 27-38). It would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have combined the teachings of Bergerson, Shores, and Columbier et al. since each of the aforementioned references are analogous insofar as being directed to thermal interface substrates.

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Therefore, it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have modified Bergerson and Shores by reinforcing the graphite layer of Bergerson with metal foil (including tin) as taught by Columbier et al. in order to improve the mechanical strength of the substrate while reducing the electrical resistance and enhancing thermal conductivity of the substrate.

8. Claims 45-46 and 63-64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bergerson ('484) in view of Shores ('549) and Columbier et al. ('737), and further in view of Oeltjen et al. ('069).

Bergerson, Shores, and Columbier et al. teach a thermally conductive interface as detailed above. The aforementioned prior art is silent as to whether the interface is cleanly releasable from the electronic components. It is notoriously well known in the hot-melt adhesive art, however, that plasticizing oil may be added to the hot-melt adhesive composition in order to form a removable hot-melt adhesive that allow separation of the adhesive from an attached substrate without substrate failure or adhesive failure as evidenced by Oeltjen et al. (Col. 1, lines 40-52). It would have been obvious to combine the teachings of Bergerson, Shores, Columbier et al., and Oeltjen et al. since each of the aforementioned references are analogous insofar as each of the four references are directed at the formation of hot-melt adhesives and/or the formation of thermal interface substrates.

Therefore, it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have modified the adhesives of Bergerson and/or Shores by including plasticizing oil as taught by Oeltjen et al. in order to impart repositionable properties to

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a hot-melt adhesive such that the adhesive is removable from an attached substrate without substrate failure or adhesive failure.

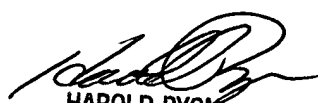
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Egan whose telephone number is 703-305-3144. The examiner can normally be reached on M-F, 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Y. Pyon can be reached on 703-308-4251. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.


BPE
August 3, 2003


HAROLD PYON
SUPERVISORY PATENT EXAMINER
1772

8/7/03